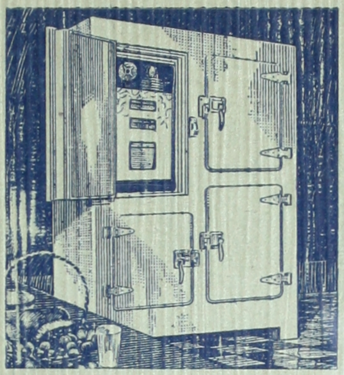


Kelvinator

The Oldest Domestic Electric Refrigeration

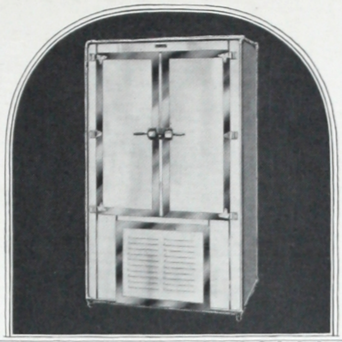
Better Always Better

READY TO FILE

Contains Complete Information on Electric Refrigeration for Dwellings

TEL.
2051 W. FORT ST.
DETROIT, MICHIGAN

STANDARD CONSTRUCTION CLASSIFICATION



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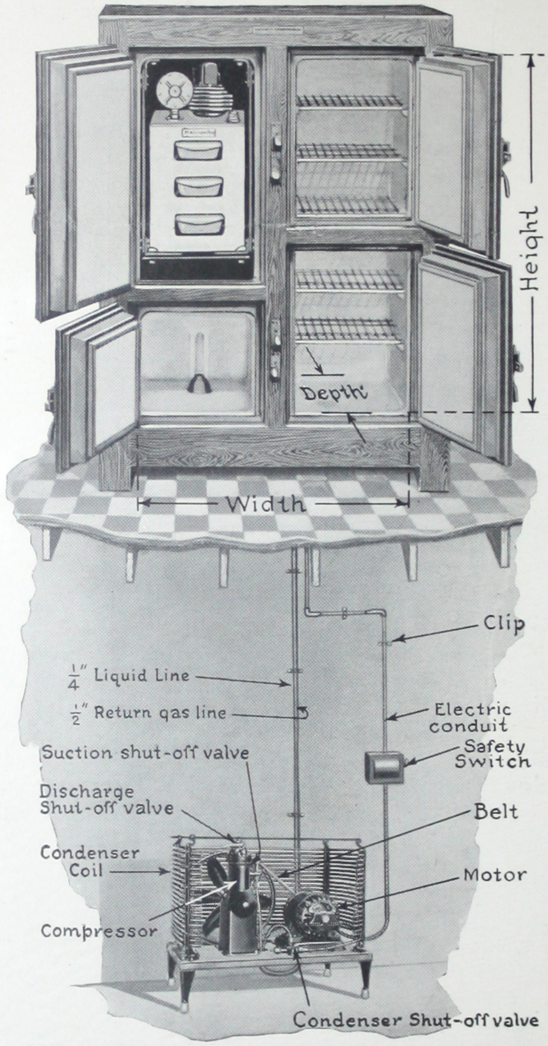


A Typical Kelvinator Installation

The above cutaway photograph shows a typical domestic installation of Kelvinator Electric Refrigeration. It illustrates a convenient and efficient placement of the control, condensing and freezing units with relation to the refrigerator itself.

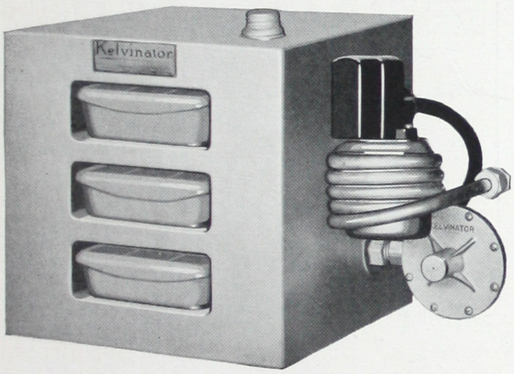
STANDARD KELVINATOR UNITS FOR DOMESTIC INSTALLATION

Kelvinator manufactures standard freezing units in a variety of types for installation in any top, side or center icing refrigerator up to 70 cubic feet, inside capacity.

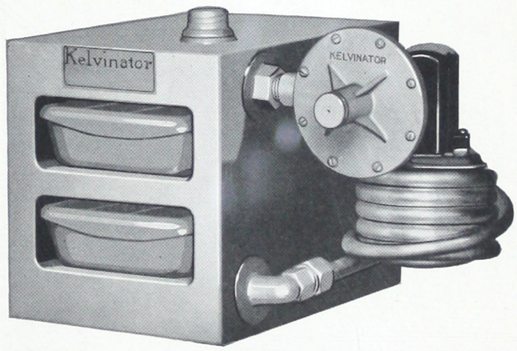
(Note—For commercial installation, Kelvinator units are available for refrigerators of larger storage capacity.)

On Page 3 of this section are shown the dimensions of all standard Kelvinator units produced with freezing tank for individual installation in refrigerators of varying size and capacity. Each drawing includes both front and side detail.

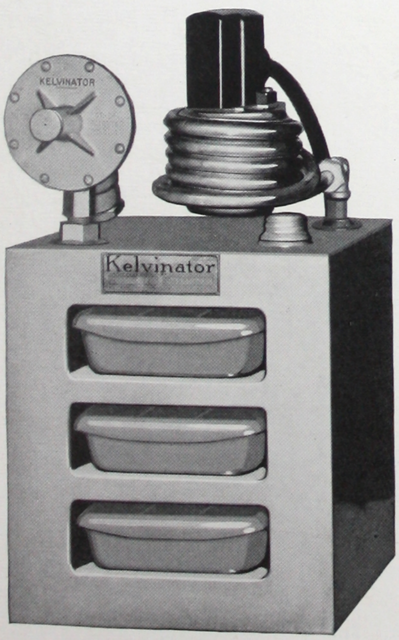
The illustrations below are of standard freezing tanks in both vertical and horizontal styles.



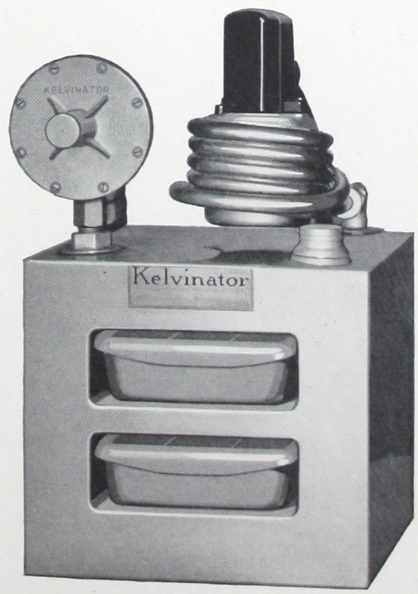
Model 010H



Model 08H

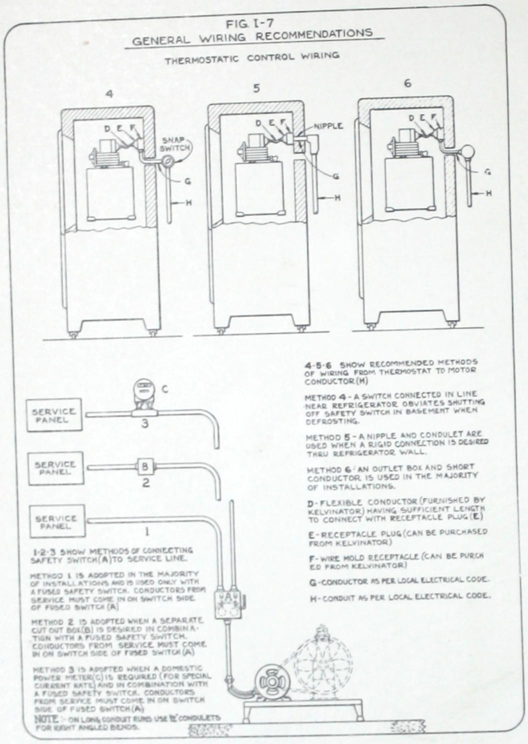


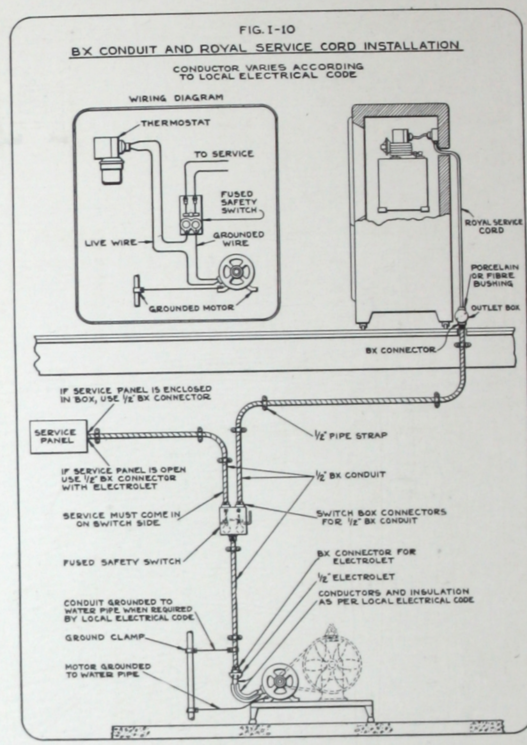
Model 010V

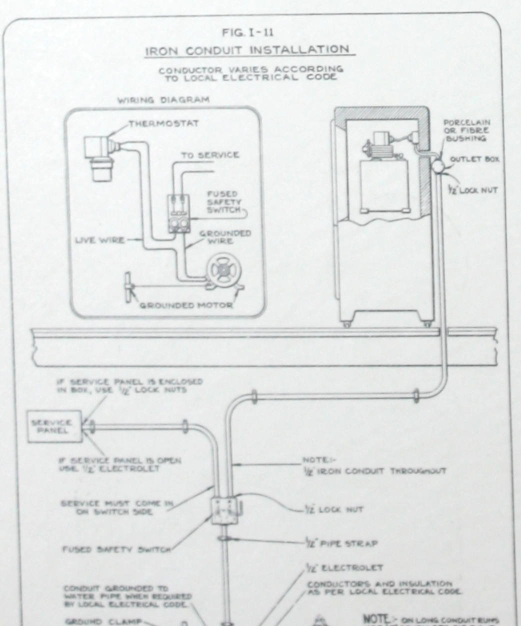


Model 08V

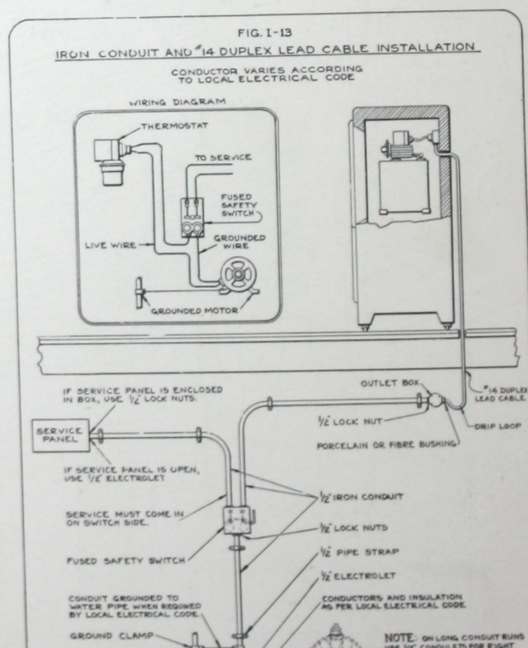
DETAIL SHOWING STANDARD SYSTEMS OF WIRING





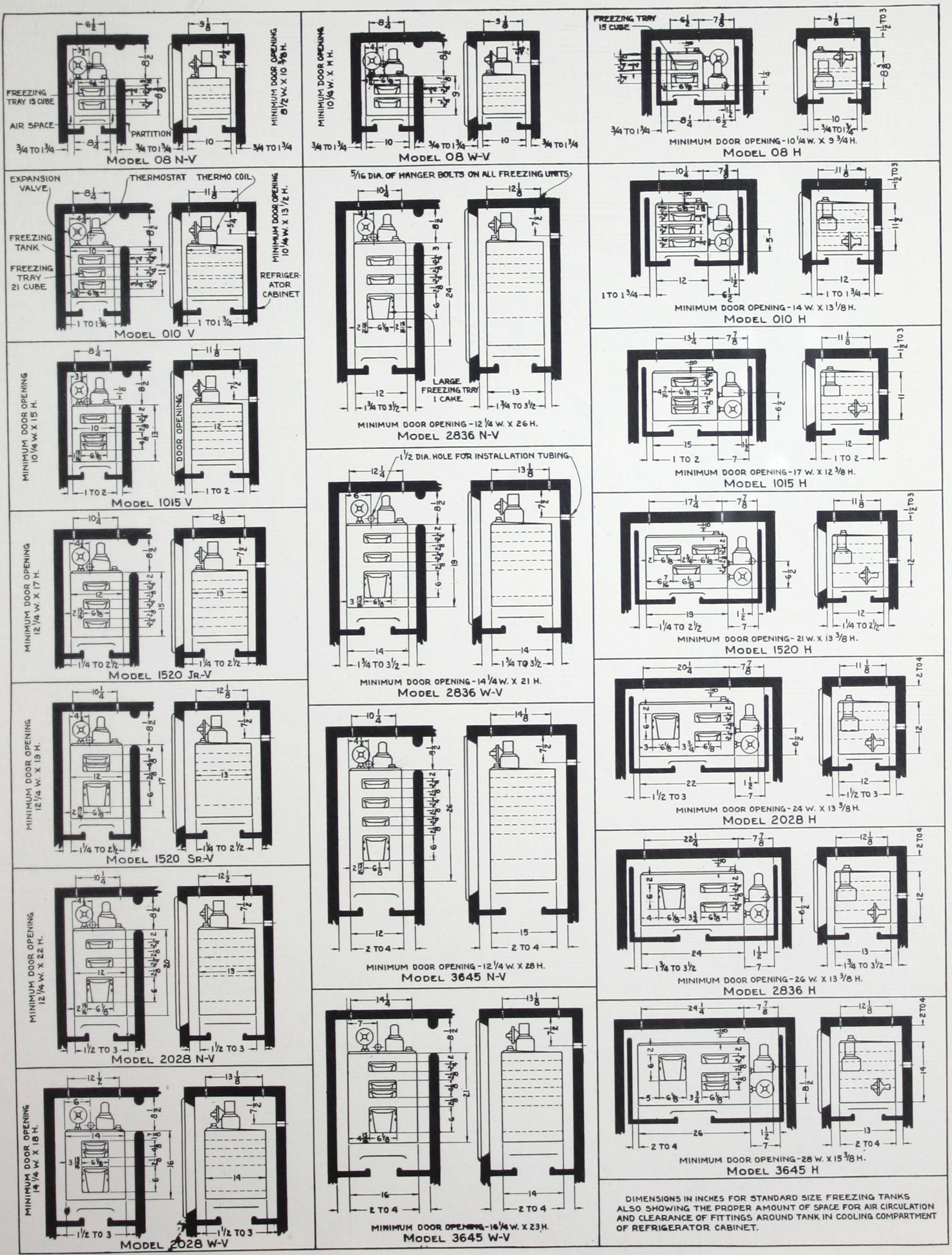


BX Conduit may be substituted for the Iron Conduit



BX Conduit may be substituted for the Iron Conduit

UNIT DIMENSIONS OF STANDARD KELVINATOR FREEZING TANK INSTALLATIONS



DIMENSIONS IN INCHES FOR STANDARD SIZE FREEZING TANKS ALSO SHOWING THE PROPER AMOUNT OF SPACE FOR AIR CIRCULATION AND CLEARANCE OF FITTINGS AROUND TANK IN COOLING COMPARTMENT OF REFRIGERATOR CABINET.

KELVINATOR 1926 FREEZING TANK TYPE MODELS (DRY SYSTEM)

Model	Cubic Feet Refrigerator Contents	MODEL	Freezing Tank Unit: Overall Dimensions * of Freezing Tank Unit: Width Inches	Overall Dimensions: Depth Inches	Overall Dimensions: Height Inches	Recommended Dimensions of Freezing Unit Compartment: Width Min. Inches	Width Max. Inches	Depth Min. Inches	Depth Max. Inches	Height Min. Inches	Minimum Dimensions of Freezing Unit Compartment Door: Width Inches	Height Inches	Freezing Trays	Ice Cubes	9¼ Lb. Cake of Ice	Gals. of Brine	Expansion Valve Setting	Maximum Allowable Length of ½ Inch Suction Tubing	Condensing Unit: Model	Overall Dimensions: Width Inches	Length Inches	Height ** Inches	SO_2 Charge Lbs.	Compressor R. P. M.
234	0-8	08–NV	8¼	10	14⅜	9¾	11¾	11½	13½	16⅞	8½	10⅜	2	30	0	1.3	½	50′	5516	17	30¼	24⅝	3	310
235	0-8	08–WV	10	10	15¼	11½	13½	11½	13½	17½	10¼	11	2	30	0	2.1	½	50′	5516	17	30¼	24⅝	3	310
236	0-8	08–H	14¼	10	9½	15½	17½	11½	13½	10⅜	10¼	9¾	2	30	0	1.3	½	50′	5516	17	30¼	24⅝	3	310
237	0-10	010–V	10	12	17¾	12	13½	14	15½	20	10¼	13½	3	63	0	2.9	½	50′	5516	17	30¼	24⅝	3	310
238	0-10	010–H	18	12	12⅝	19½	21¼	14	15½	13½	14	13⅛	3	63	0	4.1	½	50′	5516	17	30¼	24⅝	3	310
118	10-15	1015–V	10	12	19¼	12	14	14	16	21½	10¼	15	3	63	0	4.2	1	50′	5516	17	30¼	24⅝	3	310
119	10-15	1015–H	21½	12⅝	12⅛	23	25	14	16	13	17	12⅜	3	63	0	6.0	1	50′	5516	17	30¼	24⅝	3	310
120	15-20	1520–Jr., V	12	13	21¼	14½	17	15½	18	23½	12¼	17	3	63	0	7.1	1½	50′	5516	17	30¼	24⅝	3	310
121	15-20	1520–H	25½	12⅝	13⅛	27¼	29½	14½	17	14	21	13⅜	3	63	0	9.0	1½	50′	5516	17	30¼	24⅝	3	310
122	15-20	1520–Sr., V	12	13	23¼	14½	17	15½	18	25½	12¼	19	2	42	1	7.3	1½	75′	5517	17	30¼	26½	4	260
123	20-28	2028–NV	12	13	26¼	15	18	16	19	28½	12¼	22	2	42	1	9.0	2	75′	5517	17	30¼	26½	4	260
124	20-28	2028–WV	14	14	22¼	17	20	17	20	24½	14¼	18	2	42	1	8.9	2	75′	5517	17	30¼	26½	4	260
125	20-28	2028–H	28½	12⅝	13⅛	30½	33	15	18	14	24	13⅜	2	42	1	9.5	2	75′	5517	17	30¼	26½	4	260
126	28-36	2836–NV	12	13	30¼	15½	19	16½	20	32½	12¼	26	2	42	1	11.5	2½	75′	5517	17	30¼	26½	4	260
127	28-36	2836–WV	14	14	25¼	17½	21	17½	21	27½	14¼	21	2	42	1	11.2	2½	75′	5517	17	30¼	26½	4	260
128	28-36	2836–H	30½	13	13⅛	32¾	35½	16½	20	14	26	13⅜	2	42	1	11.5	2½	75′	5517	17	30¼	26½	4	260
129	36-45	3645-NV	12	15	32¼	16	20	19	23	34½	12¼	28	3	63	1	13.9	3	75′	5517	17	30¼	26½	4	260
130	36-45	3645–WV	16	14	27¼	20	24	18	22	29½	16¼	23	3	63	1	14.4	3	75′	5517	17	30¼	26½	4	260
131	36-45	3645–H	32½	13	15⅛	35	38	17	21	16	28	15⅜	3	63	1	15.0	3	75′	5517	17	30¼	26½	4	260
132	45-54	4554–V	Special Freezing Unit to Fit Refrigerator			†4	†8½	†4	†8½	....	....	....	0–8	0–168	0	....	3	50′	5517	17	30¼	26½	4.7	260
133	45-54	4554–H				†2½	†5¾	†4	†8½	†2	....	....	0–8	0–168	0	....	3	50′	5517	17	30¼	26½	4.7	260
134	54-62	5462–V				†4½	†9	†4½	†9	....	....	....	0–8	0–168	0	....	3	50′	5517	17	30¼	26½	5.5	260
135	54-62	5462–H				†2¾	†6	†4½	†9	†2	....	....	0–8	0–168	0	....	3	50′	5517	17	30¼	26½	5.5	260
136	62-70	6270–V				†4½	†9	†4½	†9	....	....	....	0–8	0–168	0	....	3	50′	5517	17	30¼	26½	6.5	260
137	62-70	6270–H				†2¾	†6	†4½	†9	†2	....	....	0–8	0–168	0	....	3	50′	5517	17	30¼	26½	6.5	260

* Includes Thermo Coil and Expansion Valve mounting.

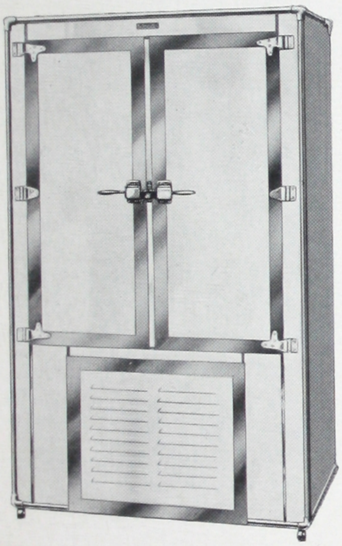
** Height with legs for which 6⅜″ are allowed.

† Add this amount to corresponding dimensions of freezing tank units.

CABINET KELVINATORS

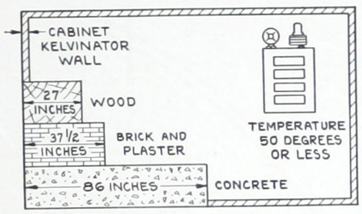
In addition to units for installation in refrigerators already in use, Kelvinator also offers a complete line of Cabinet Kelvinators—cabinets and Kelvinators combined into single units, delivered complete, ready for the electric connection. These models are illustrated below. Models 231, 232 and 233 are of the famous "Leonard Cleanable" construction.

The refrigerator itself is naturally an important factor in the efficiency of any electric refrigerating system. This line of Cabinet Kelvinators is designed and manufactured to combine various Kelvinator domestic models with quality refrigerators in a wide range of types, styles and sizes, to insure operating efficiency. The advantages of simplicity, ease of installation and flexibility in kitchen planning will be instantly apparent to architects.



Model 233

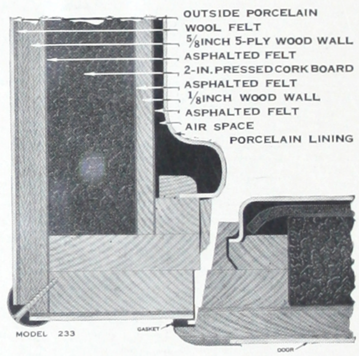
Models 233, 231, 232



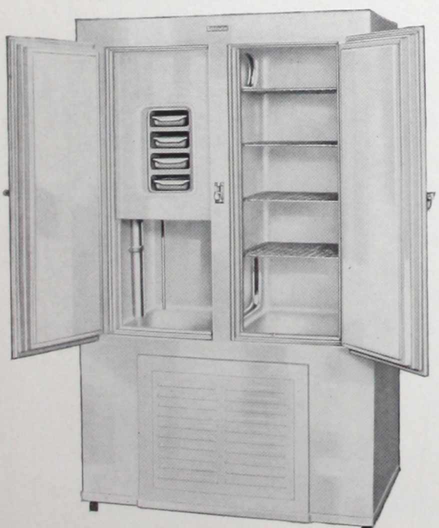
As illustrated in the above diagram, the Cabinet Kelvinator walls in models 233, 231 and 232 have an insulating value equivalent to 27-inches of wood, 37½-inches of brick and plaster, or 86-inches of concrete. It is not possible for Kelvinator refrigerator walls to absorb moisture—one of the outstanding qualities of corkboard. The three layers of asphalted felt thoroughly protect the wood, and the walls will not rot or mold.

MODEL 233

A de luxe model. Exterior is of white porcelain, handsomely trimmed with polished metal. The general construction is similar to Models 231 and 232. The outside dimensions are: 67⅝ inches high, 41 inches wide and 26½ inches deep.



Model 233 (Insulation Detail)
Wall and Door Constructions



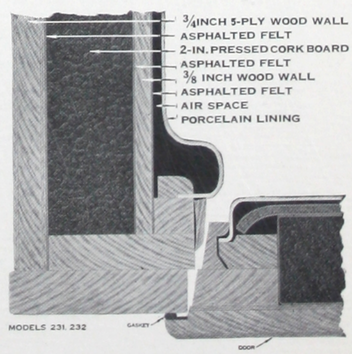
Model 231

MODEL 231

This Cabinet Kelvinator is an ideal model for the home where generous food capacity is needed. The outside dimensions of this model are: 67¼ inches high, 40¼ inches wide and 24 inches deep. It has 12 square feet of shelf space and a food storage capacity of 9 cubic feet. In the trays 84 cubes of ice (12 pounds) can be frozen at one time. Exterior finish is of highest quality white enamel pyroxylin; the interior white porcelain. Corkboard insulation is used throughout.

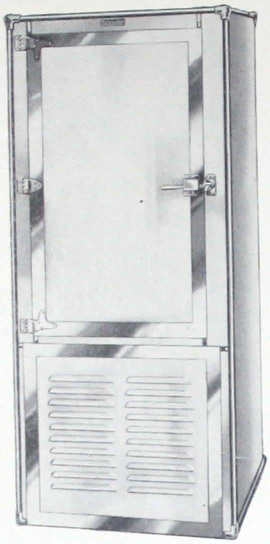
MODEL 232

Dimensions, construction, arrangment and ice capacity of this model are the same as above. The exterior finish is of quarter sawed golden oak.

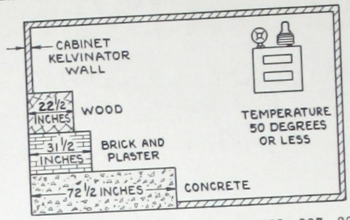


Models 231, 232 (Insulation Detail)
Wall and Door Constructions

Models 229, 227, 228, 226, 230



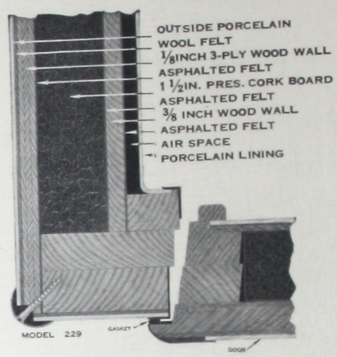
Model 229



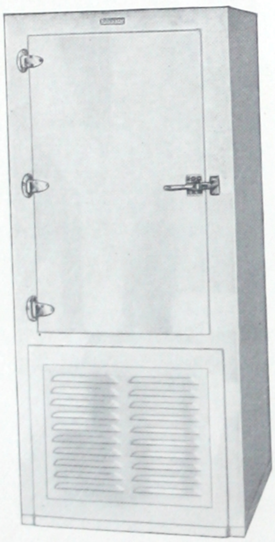
The walls of Kelvinator Models 229, 227, 228, 226 and 230 have insulating value equivalent to 22½ inches of wood, 31½ inches of brick and plaster or 72½ inches of concrete. Corkboard is moisture proof—Kelvinator refrigerator walls cannot absorb moisture. Because of the nature of the insulation itself, they are likewise vermin and germ proof, and will not rot, mold or give off offensive odors.

MODEL 229

This is a de luxe Cabinet Kelvinator. The interior and exterior are of gleaming white porcelain, beautifully trimmed with polished metal corners and edging. The shelves and ice-making capacity are the same as in Model 226. Corkboard insulation. Outside dimensions: 60½ inches high, 27¼ inches wide, 26⅝ inches deep.



**Model 229 (Insulation Detail)
Wall and Door Constructions**



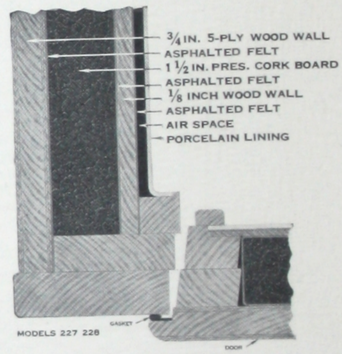
Model 227

MODEL 227

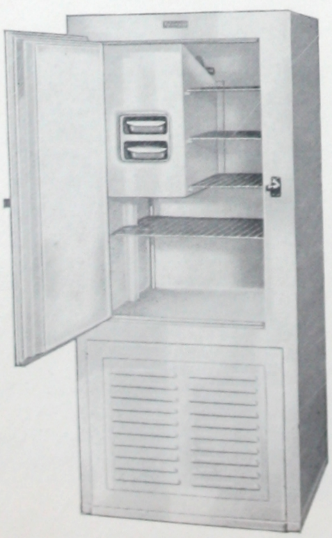
In this model Kelvinator, the interior is gleaming white porcelain on Armco Iron, making it as easy to keep clean and shining as a china dish. The design and size are the same as Model 226, with the same white enamel pyroxylin finish and the same construction.

MODEL 228

Has the same white porcelain interior as Model 227, and is of the same size and construction, but the exterior is quarter sawed golden oak.



**Models 227, 228 (Insulation Detail)
Wall and Door Constructions**



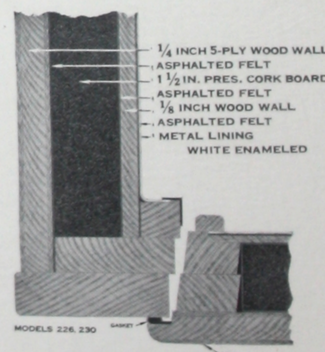
Model 226

MODEL 226

A beautiful flush-panel hard-wood cabinet finished in gleaming white enamel pyroxylin. The insulation is of corkboard. The interior is glossy white enamel on galvanized iron. The outside dimensions are: Height 60⅛ inches, width 26½ inches, depth 26¼ inches. This model has 9½ square feet of shelf space, permitting you to make excellent use of the food storage compartment of 5½ cubic feet capacity. The trays freeze 42 cubes of ice (6 pounds) at a time.

MODEL 230

This Cabinet Kelvinator is exactly the same in size and construction as Model 226, except that the exterior is of rich golden oak.



**Models 226, 230 (Insulation Detail)
Wall and Door Constructions**

WORKING SPECIFICATIONS FOR THE USE OF ARCHITECTS

Under this heading are assembled all the information and data which architects should include in complete specifications for Kelvinator electric refrigeration, with suggestions for provision of equipment related to, but not a part of, the installation.

Architects or builders should insert all the general and statistical data for which blank spaces have been provided in the following working form:

(A) The Refrigerator: The refrigerator to be equipped with electric refrigeration is No.....................

as made by..............................

(1) Refrigerator Location: ....

....

(2) Inside Dimensions (disregarding partition walls): ....wide..........high..........deep

(3) Total Cubical Contents (disregarding partition walls):..............................

(4) Location and Size of Freezing Unit Compartment:..........icer..........wide..........high

..........deep.

(5) Size of Freezing Unit Compartment Door Opening:..............................

(6) Distance of Door Sill above Ice Rack: ....

(B) Electrical Provisions: There has been provided an electric service outlet (describe and locate definitely)

....

....

(1) The service outlet is located approximately 3′-0″ above the floor and 12″ to the left from the center line of the condensing unit baseboard projected to the wall.

NOTE: The above location is for standard basement condensing unit location. If the condensing unit is otherwise located, describe in detail service outlet provisions. See also C5e.

(2) The current supplied is..........cycle..........phase..........volts, A. C.; or..........volts, D. C.

(C) Electric Refrigeration System:

(1) **Work Included:** The work included under this heading shall be the finishing and installing of a complete Electric Refrigeration System as made by the Kelvinator Division of Electric Refrigeration Corporation, Detroit, Michigan.

(a) All mechanical parts shall be in accordance with Kelvinator standard specifications, Section "E" of the 1926 catalog.

(2) **The Freezing Unit:** The freezing unit installed in the ice compartment of the refrigerator specified in (A) shall be (give Model Number from Section A, page 4).

(a) **If special size for unit of over 45 cu. ft. contents is required, describe fully, especially the ice tray equipment.**

(b) If additional ice trays are required, so state.

(3) **The Condensing Unit:**

(a) The condensing unit shall be installed (locate definitely)..

....approximately..........................feet from the refrigerator.

(b) If base board legs are to be omitted, so state.

(c) Furnish and install over top of condensing unit a ½" mesh steel wire screen on a steel frame attached conveniently with thumb screw bolts or otherwise. **(Provide where State Safety Codes require.)**

NOTE: The Kelvinator condensing unit may be located in any reasonable position in relation to the refrigerator, either above or below. Usually it is placed in a convenient location in the basement—the "Junior" within 50 feet and the "Senior" within 75 feet, measured from the top of the compartment to the base of the condensing unit. Since the unit is air cooled, the logical location gives free access to the air where the temperature is not excessive.

(4) **Installation Tubing:** Connect the freezing unit to the condensing unit with seamless copper tubing—¼" for liquid line, ½" for return gas line.

If installation tubing is to be wholly or partially concealed, so state.

(5) **Electrical Construction:** All electrical work shall be in strict accordance with the **NATIONAL ELECTRIC SAFETY CODE** and all State or local ordinances.

(a) All wire shall be No. 14 D. B. R. C.

(b) All wiring shall be enclosed in solid iron or Greenfield flexible conduit complete with outlet boxes.

(c) **If wiring and conduit is to be wholly or partially concealed, so state.**

(d) Install conduit and wiring from a wall receptacle located back of the refrigerator to the service outlet box installed in (b) to serve thermostat switch. Install in the refrigerator a plug receptacle with a white enameled brass face plate to take plug from thermostat. From refrigerator receptacle, carry B. X. wiring with plug attached to connect with wall receptacle first specified.

(e) At the service outlet provided in (b), install an enclosed, fused, externally operated switch connected to the service and thermostat switch wiring. Connect switch to motor with wiring enclosed in Greenfield flexible conduit.

(f) See Section A, page 2, for Standard Systems of Wiring.

(6) **Installation:** All work shall be installed by skilled labor in a neat, workmanlike manner. Where tubing, conduit, etc., are exposed to view, runs shall be made in a sightly, systematic manner. All bends shall be at right angles. All exposed piping shall be substantially and neatly supported by pipe straps attached to walls, ceiling, etc.

(7) Kelvinator Corporation guarantees replacement, free of charge, f. o. b. factory, Detroit, Michigan, within fifteen months from date of shipment from factory, of any part manufactured by it, which, under normal and proper use, and upon return to the factory for inspection, carriage charges prepaid, proves to the satisfaction of the corporation to be defective. Changes in the use or treatment of machines, use of devices or attachments therewith, or deviation from the published refrigerating capacity of any model when unauthorized by the corporation, automatically cancels this warranty.

ADVANTAGES OF ELECTRIC REFRIGERATION

There are four outstanding advantages of domestic electric refrigeration which deserve consideration by architects and builders—(1) convenience; (2) better food; (3) economy; (4) pride of ownership, reflected in the increased "salability" of homes so equipped.

CONVENIENCE

Electric Refrigeration Is Automatic This is one of the most obvious and most important advantages. Electric refrigeration makes its owner independent of ice deliveries. It is positive and continuous—assuring perfect condition in food supplies during any absence from home, whether for a few hours or for days at a time.

Frequent Cleaning Unnecessary Moist cold in a refrigerator compels frequent cleaning if mustiness and taint are to be avoided. The cold of electric refrigeration is crisp and dry. The scalding and thorough cleaning of the refrigerator (which is usually necessary weekly) becomes a simple task required ordinarily about once a month.

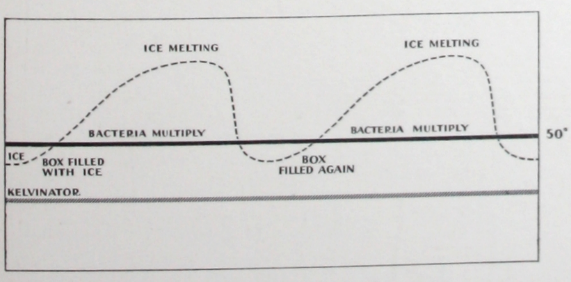
It is advisable occasionally to defrost the freezing unit, because under constant operation it becomes coated with a frost that may be thick enough to insulate it and somewhat impair its cooling efficiency. Defrosting is accomplished simply by turning off the switch at night and leaving it off until morning. During that period the freezing unit itself maintains the desired low temperature in the refrigerator, yet the frost melts and is carried off through the drain pipe. Wiping the refrigerator out at the time of defrosting is sufficient to keep it sweet and clean.

Kitchen Planning Simplified and Improved Where electric refrigeration is used the convenience of the housewife —the saving of her time and effort —can receive first consideration in kitchen planning. This is a point of utmost importance to the architect, allowing him, as it does, far greater freedom in kitchen design for appearance, convenience and utility.

The refrigerator may be located in whatever spot is most desirable with relation to other units of kitchen equipment. It may be set at any desired height from the floor. It may be built into a wall space specially designed for it, in proper relation to cupboards. It may be raised to the desired height from the floor and the space beneath it utilized for a cupboard or for drawers.

Convenience of Marketing Electric refrigeration also brings to the modern home freedom to market when it is most convenient—to buy in quantities, and to use food, cook it, preserve it, eat it as desired, without the penalty of spoilage ordinarily involved.

BETTER FOOD



The dotted line shows the fluctuation of refrigerator temperatures as ice melts—bacteria multiplying above the 50° point indicated by the solid black line. The gray line shows the temperature maintained by Kelvinator.

Refrigeration Maintained at Uniformly Low Temperature From a sanitary point of view, 50° is the critical refrigeration temperature. Government research brings out the significance of this fact in the following report: "At temperatures ranging from 40° to 50°, bacterial growth in foods is only about 1/400 as rapid as at temperatures between 50° and 60°."

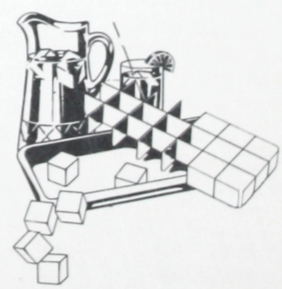
On the other hand, since most foods contain large percentages of water, too intense cold is equally injurious. Temperatures below 32° induce freezing, which breaks down delicate food tissues and hastens decomposition.

Efficient electric refrigeration maintains the refrigerator temperature always between 40° F. and 50° F.—a temperature not only lower but far more uniform than can be obtained in any other way. It provides a crisp, dry, sanitary" cold, which chills the moisture out of the air and deposits it on the freezing unit in the form of frost.

In other words, electric refrigeration provides not only a freezing surface of unchanging size, but a temperature range that is automatically held between definite limits, which have been scientifically set for the most efficient preservation of foods. Refrigerator temperatures cannot go either above or below these limits, no matter where the refrigerator is located or what the outside temperatures may be.

Electric Refrigeration Improves Foods Often, the bacterial growth due to inefficient refrigeration produces changes that affect the wholesomeness of food, yet cannot be detected by flavor or appearance. Not only does electric refrigeration **prevent** such changes, but it actually **improves** most foods. Green vegetables become crisper and fresher; meats mellow and increase in tenderness without taint; bacterial growth is practically eliminated; foods remain fresh and wholesome almost indefinitely.

Frozen Desserts and a Sanitary Ice Supply Always Assured



While automatically preserving and improving foods, electric refrigeration at the same time freezes from pure water ice cubes 1½ inches square in the smaller domestic units, and in addition, in larger installations, 9¼ lb. cakes. Delicious desserts are also available to the housewife at any time; mousses, ices, frozen puddings and similar dainties may easily be frozen in the freezing trays without the usual inconvenience and expenditure of time and effort.

A More Sanitary Refrigerator Where foods are electrically preserved, the refrigerator itself is naturally cleaner at all times. Dirt and slime are entirely absent because there is nothing to cause them, and this in itself is a factor in sanitation and the increased wholesomeness of foods.

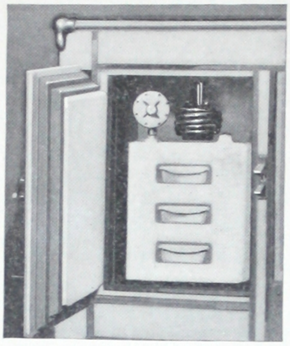
ECONOMY

Operation Costs Less Than Ice Refrigeration When comparing electric with ordinary refrigeration, we are obviously dealing with things that are not strictly comparable. The evident superiority of electric refrigeration means greatly increased **value,** which in itself represents a real economy.

Purely on a basis of dollar-for-dollar cost, however, the economy of electric refrigeration may be definitely proved under ordinary

domestic operating conditions. This saving, of course, varies with electric current rates. In general, however, an actual money saving is effected where the current rate is 8c a kilowatt or less. Naturally, this saving is materially increased where domestic users are allowed a power rate.

Tests made in 1925 by a special committee of the National Electric Light Association showed that the meter cost of current for the operation of electric refrigeration averaged only 58% of the cost of other methods, where the refrigerators compared were of the same size and type. In this survey the rate for electricity averaged 5 3/10c per kilowatt hour. These figures are based on averages for 42 cities, and may, therefore, be taken as a fair index of comparative operating costs.



Architects may be asked to estimate the cost of operating an electric refrigerator. The average current consumption is 500 kilowatts per year for a domestic unit of medium size—slightly more for large units, slightly less for small units. The cost per year, therefore, can be easily estimated by multiplying the local kilowatt rate by 500.

Less Wear and Tear Upon Refrigerator Other tests made by the National Electric Light Association show that the average life of a refrigerator not electrically operated is seven years, whereas the same refrigerator electrically operated will give good service for twenty years. The reasons for this longer life are obvious. The compartment itself in which Kelvinator is installed gets absolutely no wear. Nor is there any strain on walls and door jambs, or dampness to cause the insulation to decay. In fact, an electricaly operated refrigerator receives no more wear and tear than a pantry shelf.

Food Waste Reduced Elimination of food spoilage is a very important factor of economy in electric refrigeration. It is not an item that may be definitely estimated in dollars-and-cents in any specific case, but even the most casual comparison of the two systems establishes the fact beyond question.

Quantity Food Purchases an Added Economy This fact likewise requires little comment. Ability to preserve food longer and in larger quantities is naturally reflected in a saving through purchasing in larger units.

ADDED VALUE OF THE HOME

Final Mark of a Modern Home Electric refrigeration is a strictly modern convenience, an evidence of higher living standards, a domestic utility excelled by none as a contribution to the well-being of its owner.

Because of these facts, there is a pride of ownership in possession of an electric refrigerator that is of distinct value not only to home owners, but to home designers and home builders.

The pride and satisfaction common to those who enjoy electric refrigeration in the home—as well as the tangible benefits of this modern refrigeration method—add definitely to the value of the house in which it is installed. This increased value is reflected in better kitchen design, in increased salability, and in higher rental value. It is, therefore, a factor that deserves more than passing consideration by architects and builders on this score alone.

KELVINATOR'S SOLUTION OF THE SIX BASIC PROBLEMS

OF HOUSEHOLD ELECTRIC REFRIGERATION DESIGN

In domestic refrigeration, there are six basic problems of design, upon the solution of which depends the efficiency of the system.

Since Kelvinator first started pioneer work in this field, exhaustive tests have been made of every available alternative under these six headings, and the specific element adopted by Kelvinator in each case has been chosen on a basis of sound engineering theory upheld by the results of practical experience.

1. Which Refrigerant?

Kelvinator uses anhydrous sulphur dioxide (SO_2). For reasons, see (1) on this page.

2. Which System of Expansion?

Kelvinator uses the "dry" system for all individual domestic installations—the "flooded" system for large commercial and multiple installations. For reasons, see (2) on this page.

3. Which System of Automatic Control?

Kelvinator uses thermostatic control for single domestic installations, and pressure control for large commercial and multiple units. For reasons, see page 14 (3).

4. Indirect or Direct Heat Transfer?

Kelvinator uses the indirect (storage or freezing tank) system for all individual domestic installations. For reasons, see page 15 (4).

5. What Type of Compressor?

Kelvinator uses the reciprocating type, both one cylinder and two cylinder, according to the installation. For reasons, see page 15 (5).

6. How to Condense the Refrigerant?

The Kelvinator condenser is air cooled. For reasons, see page 15 (6).

Fundamental Reasons For Kelvinators Choice of Basic Elements

1. *Why Kelvinator Uses Sulphur Dioxide as a Refrigerant*

Of the substances which vaporize at low temperatures and which are practical for use as refrigerants, we need consider here only the three most commonly employed—sulphur dioxide (SO_2) which vaporizes (or boils) under atmospheric pressure at 14° F. above zero; methyl chloride, which vaporizes at 11° F. below zero; ammonia, which vaporizes at 28° F. below zero.

In itself the point of vaporization has little practical significance aside from the fundamental requirements that it shall be low enough to assure adequate refrigeration; yet it has considerable bearing on other factors that determine refrigerating efficiency. The superiority of sulphur dioxide as a refrigerant is definitely indicated by the following points:

(a) **Greater Stability** An efficient refrigerant must be able to withstand changes in temperature without undergoing chemical or physical decomposition. Sulphur dioxide is the most stable of all refrigerants. It does not break down under normal operating conditions, and it does require less service and less frequent replenishment.

(b) **Less Condensing Pressure Required** Only 90 lbs. gauge pressure is required to liquefy sulphur dioxide when the temperature of the condensing air is 85° F. Refrigerants with lower vaporizing points naturally require higher condensing pressure. This means not only that less power is consumed in liquefying sulphur dioxide, but that mechanical parts will wear longer and that there is less liability of leakage caused by continued high pressure.

(c) **Possible Leaks More Quickly Found and Repaired** Leaks are rare in any well constructed compression system, and are practically unknown in Kelvinator under normal operating conditions. Yet it is obviously desirable that in case a refrigerating gas should escape, the leak should be immediately located and repaired. Sulphur dioxide has a noticeable odor and its presence in the air is at once detected. A simple process, known as the "smoke test" makes it possible to find the location of even a very tiny leak easily and quickly. This test consists of running a rag saturated with common household ammonia over the tubing and connections. When ammonia comes in contact with sulphur dioxide it produces a dense white smoke at the point of leakage, thus making possible an immediate repair. Leaks cannot be so readily located with any other commercially used refrigerant.

(d) **Non-inflammable Non-poisonous Non-corrosive** Sulphur dioxide is a **safe** refrigerant, being non-inflammable and non-poisonous to human life, and having no corrosive action on the metals used by Kelvinator.

(e) **Better Lubrication** Because of its chemical and physical nature, sulphur dioxide is superior to all other refrigerants in supporting and assisting lubrication throughout the compression system. It thus plays an important part in minimizing upkeep and repairs.

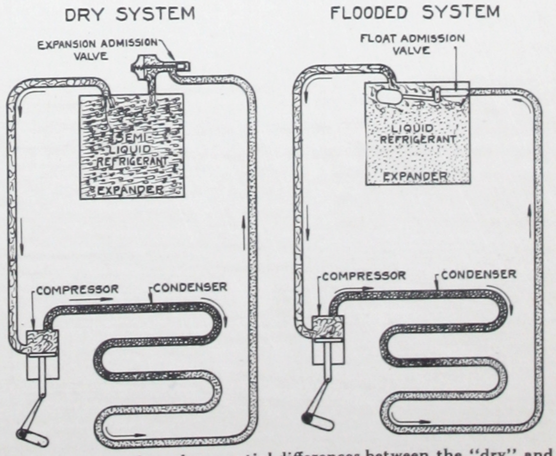
(f) **Endorsed by Experience** The superiority of sulphur dioxide is amply demonstrated by the fact that it is the standard refrigerant used in more than 90% of the household refrigerating machines now in use. Kelvinator led the way in adopting it, and has used it longer than any other manufacturer of domestic refrigeration on the market.

2-A. *When and Why Kelvinator Uses the "Dry" System of Expansion*

The difference between the "dry" and "flooded" systems of expansion is simple.

In the "dry" system of expansion, the refrigerant, when admitted to the evaporator, is already in a semi-vaporized state, being sprayed through an admission valve. The semi-vaporized liquid fills the evaporator very rapidly under this system, and its complete vaporization is also rapid.

Under the "flooded" system of expansion, a float valve is used to admit the refrigerant to the evaporator. The refrigerant enters and fills the evaporator as a liquid.



These diagrams show the essential differences between the "dry" and "flooded" systems of expansion—with the expansion admission valve used in the "dry" system and the float valve in the "flooded" system.

For all individual domestic installations, Kelvinator uses the "dry" system, for the following reasons:

(a) **Better Adapted to Operation of Single Refrigeration Units** (1) It requires less refrigerant. (2) It permits use of a sturdy expansion valve, less liable to damage in shipment or use. (3) Its operation is not affected even though the refrigerator is so located as to be subject to vibration or change of level, as in a boat.

(b) **Easily Serviced** In the "dry" system the expansion valve is entirely outside of the freezing unit, and thus is easily accessible for repairs or replacement. Such servicing is particularly simple in the Kelvinator, as all parts are standardized and interchangeable. In the "flooded" system, however, the float valve which admits the refrigerant to the evaporator is inside the evaporating unit.

(c) **Compressor Unit May be Located Wherever Desired** Under the "dry" system of expansion, it makes no difference whether the condensing unit is located above or below the evaporating unit; it may be placed in any position within reason. Since much less refrigerant is carried in the "dry" system, and since this is in a semi-liquid or vaporous state, the compressor easily handles both the refrigerant and the oil for lubrication.

In the "flooded" system, on the other hand, it is essential that the condensing unit be below the evaporating unit, if lubrication troubles are to be avoided.

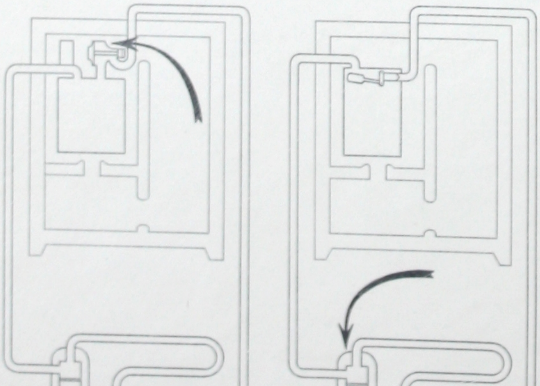
2-B. *When and Why Kelvinator Uses the "Flooded" System of Expansion*

Engineering theory and Kelvinator experience have demonstrated the superiority of the "dry" system of expansion for general domestic use. Certain types of commercial installation in general, however, call for consistently lower temperatures than are desired in household refrigeration, and the "flooded" system is better adapted to such installations.

In the "flooded" system, the refrigerant is in liquid form throughout practically the entire cycle, and the refrigeration line carries more sulphur dioxide than is used under the "dry" system. This serves admirably the purpose of refrigeration at lower temperatures, which require a larger volume of refrigerant. Kelvinator has for this reason standardized on a highly efficient form of the "flooded" system for use in the larger commercial units.

3-A. *When and Why Kelvinator Uses Thermostatic Control*

There are two available systems of automatic control for electric refrigeration—by thermostat and by pressure. The difference between them is simple and fundamental. Where thermostatic control is used, the thermostat is located inside the refrigerator, and starts and stops the motor as the temperature within the refrigerator rises or falls. Thus, actual refrigerator temperatures, in the compartments in which food is kept, govern the operation of the machine.



Where thermostatic control is used, the thermostat is within the refrigerator itself, as indicated in the diagram at the left—and operation of the mechanism is controlled by temperatures at that point. Under the pressure system of control, the control mechanism is part of the condensing unit, as indicated by the arrow in the diagram at the right—and operation is governed by pressure in the refrigerating line.

Under the pressure system, starting and stopping of the motor is controlled by the pressure in the refrigeration line. The control switch is located on the condensing unit, in the suction or "return" line from the evaporating unit. When the machine is not in operation the pressure builds up on the suction side until a determined point is reached. Then the switch cuts in the motor, and the machine operates until suction pressure has been reduced to the established limit, at which time the switch cuts off the motor. The pressure limits at which the motor cuts in and out may be adjusted and set to the particular needs of a specific installation.

Following are three important reasons why Kelvinator uses thermostatic control for all individual domestic installations:

(a) **Refrigerator Temperatures Directly Govern Operation** The efficiency of a refrigerating unit depends chiefly upon its sensitiveness and its automatic response to temperature in the food compartments. Both the position and the operation of the Kelvinator thermostat are such that it reacts directly and quickly to changes in refrigerator temperature—as when warm food is placed within the refrigerator or when its doors are open.

(b) **Motor in Operation Only When Necessary** A single definite factor—temperature, at the one vital and important point—controls the operation of Kelvinator. No conditions outside the refrigerator can operate to cause unnecessary motor stops and starts, which would involve waste of current.

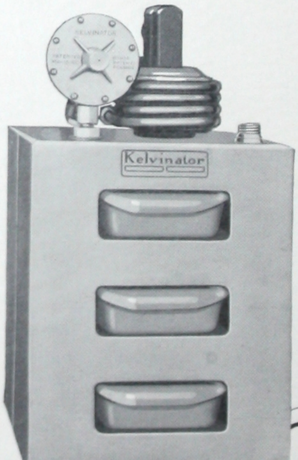
(c) **Easily Serviced** The Kelvinator thermostat is conveniently placed; may be readily inspected and adjusted; may even be temporarily removed without interruption of refrigerating operations.

In fact, if the thermostat actually needs repairs, the service man simply puts on a new one (a five-second operation) and takes the one needing repair back to his shop.

3-B. *When and Why Kelvinator Uses Pressure Control*

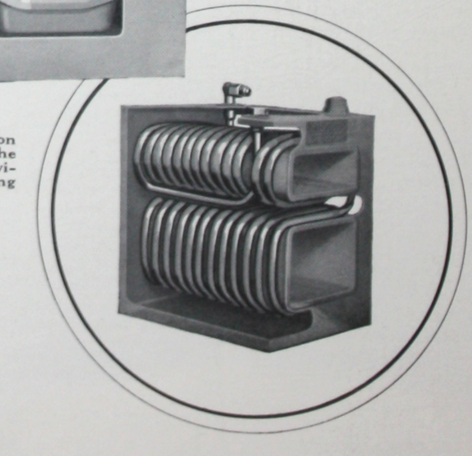
Thermostatic control, as we have demonstrated, is definitely superior in the operation of individual domestic refrigeration units, and is standard in all Kelvinator installations in which the "dry" system of expansion is used.

In the case of the larger commercial and multiple installations, where the "flooded" system of expansion is used, pressure control is more practical.



The illustration above shows the complete Kelvinator freezing unit.

Below—**a cutout view showing construction of the freezing tank and the exclusive Kelvinator method of winding the refrigerating coil around the tray sleeves.**



4. *Why Kelvinator Uses Indirect Heat Transfer*

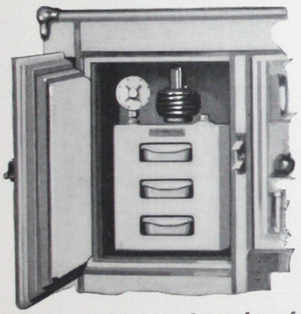
In both the direct and indirect systems of heat transfer, the refrigerant is vaporized in coils, which expose the largest possible amount of radiating surface. There is only one difference between the two systems. Where indirect heat transfer is employed, the coils are immersed in brine (in the case of Kelvinator a calcium chloride solution) within a copper tank. In direct heat transfer, the coils are exposed to the air.

Use of the indirect system with the freezing tank, increases cost of production somewhat; yet Kelvinator's long experience has proved the superiority and final economy of this design for individual domestic installations. The advantages of the indirect system are as follows:

(a) The Freezing Tank Stores Up Cold Uniform cold is the chief essential of good refrigeration. The volume of chilled brine within the Kelvinator tank constitutes "a reservoir of stored up cold" which, while it reacts readily to definite changes of temperature within the refrigerator, is not sensitive to such things as the opening and closing of a door or other factors that might react upon the exposed coils, and cause frequent starts and stops of the refrigerating machine even though the general temperature of the refrigerator had not been affected.

(b) A Safeguard Against Interrupted Service With the uniformly excellent service given by light and power companies today, interruptions of current are few and far between. In every home, however, whether with or without electric refrigeration, fuses may blow out, or storms and accidents result in a temporary shutting off of current.

During such an interruption, the refrigerating system naturally cannot go on producing cold. In Kelvinator individual installations, however, a refrigerating temperature has been stored up in a volume of brine large enough to maintain effective refrigeration for at least 24 hours—far more time than is ever likely to elapse before current is available again.



The smooth, rectangular surface of the freezing tank is itself easily kept clean, and is also so installed that cleaning the compartment around it presents no difficulties.

(c) A Clean, Regular Shaped Unit of Good Appearance

The freezing tank of the Kelvinator is designed to require the least possible care. Its smooth, rectangular surface is easily and quickly wiped clean, and is attractive in appearance.

(d) Lower Operating Expense and Upkeep

Because of the stabilizing influence of the storage tank, the number of starts and stops of the operating motor during a day is relatively small. Actual tests show that the individual domestic units in which Kelvinator uses this indirect freezing system require only one-fourth as many motor operations as machines of equal capacity which use direct heat transfer.

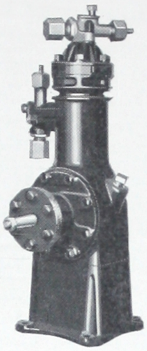
Naturally, this means longer life for the motor and less current consumption. Even though the motor were in operation exactly the same number of hours under both systems, indirect heat transfer would still prove more economical, as initial starting torque requires more current than steady operation, and added to this there is increased wear and tear on the moving parts of the compressor units.

5. *Choice of the Compressor*

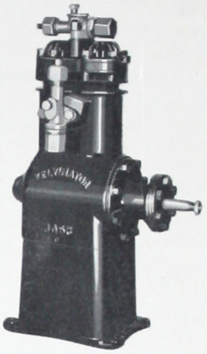
Ninety-five per cent of the domestic refrigerating machines in use are equipped with a compressor of the reciprocating type—that is, one in which the gas is drawn into the cylinder during the down-stroke of the piston, and is compressed and forced out by the upstroke. Following the most approved engineering practice, the Kelvinator compressor is of this type, though equipped with special Kelvinator features described in detail on page 20 (b).

Kelvinator standardizes on two compressor sizes: the "Junior" compressor, a single-cylinder machine generally used for refrigerators below 20 cu. ft. capacity; and the "Senior" compressor, a 2-cylinder machine for refrigerators of from 20 cu. ft. to 70 cu. ft. capacity.

Which of these two compresssors is to be used in a specific installation is determined by the particular conditions affecting the economy and efficiency of operation. In a general way, the size and condition of the refrigerator itself determine whether the 1-cylinder or the 2-cylinder machine shall be installed. The demands which the system must meet also have an important bearing on the size of compressor needed. For instance, restaurants or stores where refrigerator doors are opened frequently, require more refrigeration, and hence more pumping capacity.



One Cylinder "Junior" Kelvinator Compressor



Two Cylinder "Senior" Kelvinator Compressor

6. *Why the Kelvinator Condenser is Air Cooled*

Two distinct types of cooling systems have been used in domestic electric refrigeration—air cooling and water cooling.

In air-cooled machines, the condenser coils are exposed to the air and thus cooled by bringing the gaseous refrigerant in contact with the lower temperature around it. Where the condenser coils are water-cooled, they are either submerged in water or placed within larger pipes through which water is circulating.

The air-cooled condenser, standard in Kelvinator, is efficient, simple and satisfactory in operation, having the following definite advantages:

(a) Lower Cost of Installation When the condenser is water-cooled, the extra expense of piping water to the condenser unit is added to the normal installation cost. Sometimes, too, the difficulty or expense of providing a water supply makes it impossible to place the condenser unit in the most logical and convenient location.

Since air is always available, there is no problem of inconvenience or expense to be met.

(b) Lower Operating Cost Water is an item of cost to be considered where the water supply is metered and paid for by the householder. Furthermore, since the water-cooled system requires at least fifty mechanical parts that are unnecessary in an air-cooled machine, upkeep and repair costs will obviously be increased.

(c) Less Liability of Uninterrupted Service There are times when the water supply in any community is interrupted. Should this occur when the owner is absent, serious damage may result in a water-cooled system. If water fails, the compressor continues pumping in an effort to compensate by increased pressure the lack of condenser cooling. This overloads the motor.

(d) No Danger of Freezing Since both refrigerator and condenser would naturally be located in the coolest place convenient there is serious danger of freezing in winter with a water-cooled system—a danger that does not exist where the compressor is air-cooled.

(e) Greater Dependability Climate and weather determine to a marked extent the operating efficiency of a water-cooled system. In some sections the water is so warm that its cooling capacity is very low. In other sections there is the danger of freezing in cold weather.

Air cooling works satisfactorily and dependably under all conditions—on mountain tops and in deserts, on land and on sea. Air, at any temperature, if freely moving, has ample capacity to absorb heat and insure efficient condensation.

VIEWS OF TYPICAL KELVINATOR EQUIPPED APARTMENTS

MECHANICAL OPERATION—THE CYCLE OF KELVINATION

THERE is nothing mysterious or complicated about the mechanics of Kelvination—the process of refrigeration as carried on by Kelvinator.

Kelvination is a simple cycle of physical movement and change in which the same refrigerant is used over and over again, absorbing heat within the refrigerator at one point in the cycle and releasing it outside the refrigerator at another point.

In the ice compartment of any standard refrigerator is placed a copper tank, known as a freezing unit, as large as the dimensions of the compartment will allow and still permit the proper circulation of air. The installation itself is simple and requires but a very brief time. This tank is filled with calcium chloride brine—a mixture used because it will not freeze until it reaches a temperature far below the freezing point of water, and which will, for that reason, store up and hold the "cold" generated in the process of refrigeration.

The system of copper tubing is filled with anhydrous sulphur dioxide—the refrigerant used in Kelvinator.

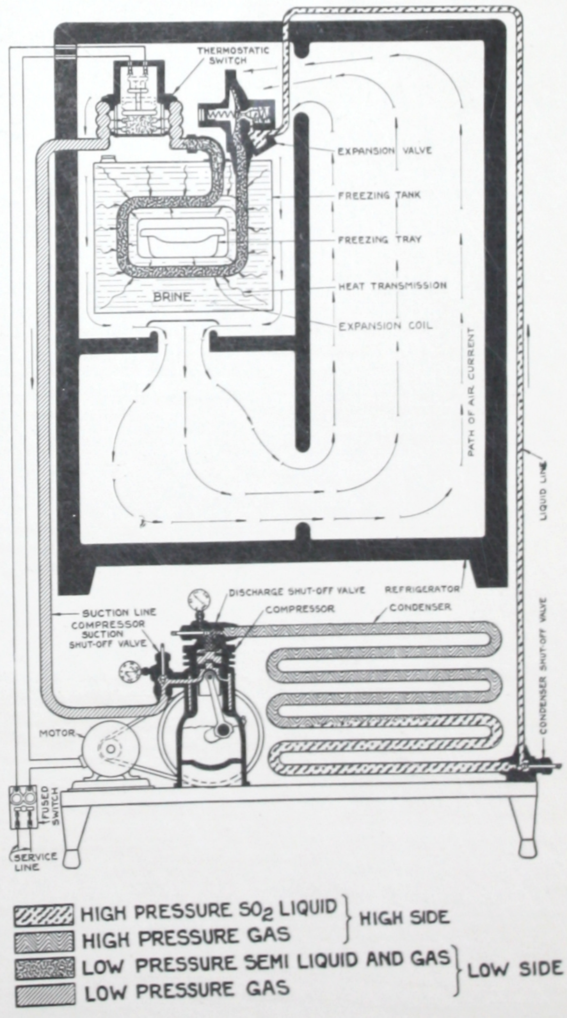
A description of the cycle of Kelvination may start with the actual refrigeration. A quantity of the liquid sulphur dioxide is admitted into the coil immersed in the freezing tank within the refrigerator. Sulphur dioxide boils and vaporizes at 14° F. above zero under ordinary atmospheric pressure. Since the brine is warmer than 14°, the sulphur dioxide boils and is transformed into a gas just as water is transformed into steam when it boils.

In boiling or vaporizing a liquid absorbs heat from its surroundings. Hence, as the sulphur dioxide is transformed into a gas it draws heat from the brine surrounding it, and thus chills the entire contents of the freezing tank, and consequently the surface of the tank and the air within the refrigerator.

The sulphur dioxide, in the form of a gas, then leaves the refrigerator, and passes through a tube to the compressor, which may be located in any convenient place—above the refrigerator or beneath it, or in the basement. The compressor is simply a pressure pump operated by a ¼ H. P. motor, which starts running when the temperature in the refrigerator rises to a certain fixed degree, and which stops running when the refrigerator is cooled off to the desired point. This starting and stopping is governed by the thermostat within the refrigerator.

Placing a liquid under pressure raises its boiling point. Sulphur dioxide, which vaporizes at 14° when under atmospheric pressure, boils at 26° under 5 lbs. pressure, at 36° under 10 lbs. pressure, at 45° under 15 lbs. pressure, and so on. Under 65 lbs. pressure it will not vaporize until a temperature of 97° above zero is reached. Consequently, when the sulphur dioxide gas is placed under pressure by the pump it resumes its liquid form, giving up the heat it has carried from the refrigerator to the outside air. It is then ready to pass up to the refrigerator as described above.

This is the cycle of Kelvination—a process essentially the same in all standard Kelvinator installations, though some differences in design are involved in the application of these simple and unchanging refrigeration principles to certain types of installation.



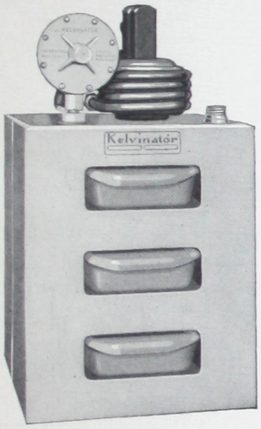
The diagram above shows the course of the refrigerant through the complete cycle of Kelvination. The physical forms of the refrigerant at various points in the cycle are indicated by the shading.

THE MAJOR UNITS OF THE KELVINATOR SYSTEM

I—Kelvinator Freezing Unit

The Kelvinator freezing unit includes that portion of the system within the ice compartment of the refrigeration and directly connected with the processes of refrigeration. Four distinct parts comprise the freezing unit—the freezing (or brine) tank, the expansion coil, the expansion valve, and the sleeves and ice trays. Copper tubes, of course, lead to the freezing unit from the condenser, and from the freezing unit to the condenser.

(a) Freezing Tank This is a hollow tank of sheet copper, tinned on the outside, rectangular in shape and designed to fit the ice compartment. Copper is used because it does not rust, and because it conducts heat from seven to eight times as rapidly as iron or steel.



Except for the space occupied by the expansion coil (within which the actual refrigeration is accomplished), the freezing tank is entirely filled with a solution of calcium chloride brine, which is maintained by Kelvination at a temperature between 18° and 22°F. above zero.

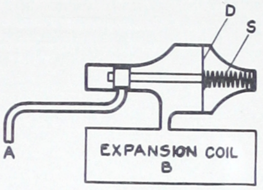
The freezing point of a strong solution of calcium chloride is 6° below zero—so low that there is no possibility of the brine freezing. Nor does calcium chloride brine corrode non-ferrous metals.

(b) Expansion Coil Inside the storage tank is the expansion coil—a continuous length of ½-inch copper tubing looped in such a manner as to provide maximum radiation surface, and to surround completely each tray used for freezing ice cubes. This arrangement of the coils was developed and patented by Kelvinator, and is an exclusive Kelvinator feature.

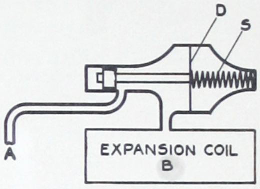
The Kelvinator coil contains only two joints—one where it is connected to the expansion valve for the admission of the refrigerant and the other where the coil is joined to the tube which carries the vaporized SO_2 back to the condensing unit. This simple construction has the obvious advantage of strength and solidity over systems in which each loop in the coil has one or two joints—a total of perhaps 40 or 50 joints on each coil.

(c-1) Expansion Valve "Dry" System The expansion valve which admits the refrigerant into the freezing unit, is, under the "dry" system of expansion, located just outside the freezing tank of the refrigerator. It is sturdily built, dependable, trouble-free.

This expansion valve works on the principle of balanced pressure. A spring holds the valve plunger open to spray into the expansion coil a small quantity of refrigerant at a time. As this vaporizes in the expansion coil, it creates pressure which backs up against a small metal diaphragm. When this pressure has become sufficient to over-balance the spring pressure in the other direction, it forces back the diaphragm and closes the entrance port, shutting off the in-flow of the liquid refrigerant.



Kelvinator Expansion Valve, Closed



Kelvinator Expansion Valve, Open

The expansion valve maintains a uniform pressure in the expansion coil, regardless of the condenser pressure. It is adjustable to maintain pressure from 2 inches of vacuum to 3 lbs. per square inch, as conditions require.

(c-2) Expansion Valve—"Flooded" System As previously stated, the "flooded" system of expansion is used by Kelvinator in the larger commercial installations, with low pressure control instead of control by thermostat.

The refrigerant is in liquid form, instead of a semi-liquid state, when it enters the evaporator—and admission of the sulphur dioxide to the evaporator is governed by a float valve.

Under this system, the refrigerant vaporizes in the evaporator and passes on to the compressor where it is compressed to a pressure of approximately 75 lbs. per square inch. As vaporization proceeds in the coils, the liquid surface of the refrigerant falls, and the float valve opens and allows sufficient liquid to enter to attain the level required to close the valve.

(d) Sleeves and Ice Trays Set into the freezing tank of the Kelvinator are openings called "sleeves" into which fit the trays for freezing ice cubes and dainty desserts. The number and size of tray receptacles varies with the size and capacity of the freezing unit.

The winding of the continuous copper expansion coil around each sleeve (as found only in Kelvinator) has the advantage that each tray is surrounded—at top and bottom and on both sides—with a coil filled with vaporizing refrigerant. This is one of the factors which insure sharp, quick freezing of ice cubes or desserts.

II—Kelvinator Condensing Unit

The condensing unit (that portion of the refrigerating system which re-condenses the refrigerant from gaseous to liquid form) consists, in the Kelvinator, of three parts—the electric motor, the compressor and condenser.

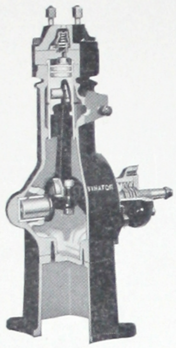
(a) The Motor A ¼ horsepower repulsion-induction motor is used in all Kelvinators for domestic use. While Kelvinator Corporation does not build the motors with which its units are equipped, it supplies motors of the highest quality, made to Kelvinator's specifications and guaranteed by the manufacturer to give economical and dependable service.

Kelvinator repulsion-induction motors are built for: (1) Low starting current consumption; (2) unusually high starting torque; (3) ability to start a heavy overload; (4) ability to start and operate under low or fluctuating voltage; (5) low current consumption while operating at normal speed; (6) constant speed under varying load.

Kelvinator motors require no attention except oiling the bearings twice a year.

The motor is belted to the compressor flywheel with a rubber and fabric "V" belt. This type is best adapted to hard service, is

quiet, and does not slip. Kelvinator belts are manufactured to conform to the most exacting Kelvinator specifications.



Cutout View of Kelvinator One-Cylinder Compressor

(b) The Compressor

The single cylinder compressor is shown in the accompanying illustration. As previously explained, Kelvinator also uses a two-cylinder compressor, which is similar in design except for the added cylinder.

While the compressor in any system of automatic refrigeration is simply a pump, compressor construction as developed by Kelvinator includes four mechanical features which add to durability and insure more dependable service:

1. The piston operates on a crankshaft instead of an eccentric—which insures stability and prevents uneven wear on the bearing surface.

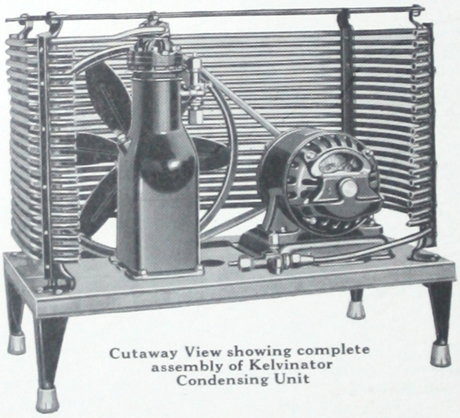
2. The compressor always operating at low speed (310 R.P.M. for the one cylinder and 260 R.P.M. for the two cylinder), the crankshaft does not require counterbalancing.

3. The piston is fitted with two piston rings, which reduce wear, eliminate unnecessary noise and add to compression efficiency.

4. The cylinder is fitted with replaceable sleeves, which take up all wear, and are easily and economically replaced if necessary.

(c) The Condenser

The entire Kelvinator condensing unit is mounted on a base, as illustrated on this page. Looped around the unit above the base is a coil of copper tubing, so placed that fan blades set in the flywheel of the compressor force a current of air through the coil.



Cutaway View showing complete assembly of Kelvinator Condensing Unit

The principle used here is that of heat transfer. The gas in the condenser coil is under a pressures that raises its boiling point to a temperature higher than the temperature of the air surrounding the coils. Consequently, the SO_2 is transformed from a gas into a liquid. In the process, it gives off the heat which it had absorbed when it was changed from a liquid into a gas in the evaporator.

Operation of the compressing pump automatically increases pressure upon the gas in the condenser coil until it reaches the point at which the gas liquefies. This point varies with the temperature, as shown in the following table.

GAUGE PRESSURES	CORRESPONDING TEMPERATURES (Fahrenheit) at which liquid SO_2 will boil or gaseous SO_2 will condense.
0 pounds pressure	14° F. above zero
5 " "	26° " " "
10 " "	36° " " "
15 " "	45° " " "
20 " "	52° " " "
25 " "	59° " " "
30 " "	65° " " "
35 " "	71° " " "
40 " "	76° " " "
45 " "	81° " " "
50 " "	85° " " "
55 " "	89° " " "
60 " "	93° " " "
65 " "	97° " " "

To illustrate—If the temperature of the sulphur dioxide refrigerant is 85°, it will require a gauge pressure of only 50 lbs. to condense it into liquid form. The converse is equally true. If the refrigerant in gas form, as it comes from the expansion coil, is compressed to 50 lbs. and discharged into the condenser at this pressure, the gas will condense at any temperature lower than 85° F. and the heat will flow from the gas in the coil to the air in the room. If temperature should for any reason run to a higher level, the pressure automatically goes higher until the condensation point is reached.

III—Kelvinator Controlling Unit

This unit of the Kelvinator consists of the thermostat and thermo coil.

(a) The Thermostat For efficient refrigeration, it is not sufficient to control the feeding of the refrigerant into the expansion coil. There must also be some control over the compressor, to stop it when the temperature within the refrigerator has reached the desired point.

In all installations of individual domestic Kelvinators, this control is by means of a thermostat—adopted by Kelvinator for reasons given in (Section E-3).

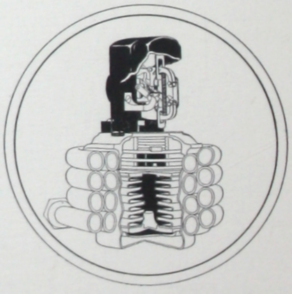
The thermostat is placed **inside** the refrigerator, on top of the freezing unit, beside the expansion valve, and surrounded by the thermo coil, which is simply a spiral of copper tubing through which the SO_2 gas circulates as it leaves the freezing unit. Operation of the thermostat is very simple—the principle of expansion with increase of pressure and contraction with decrease of pressure. The accompanying illustration shows how this principle is harnessed for use in Kelvinator.

The thermostat bellows and assembly fit inside the thermo coil. The bellows is made of thin copper; and sealed within the bellows is a small amount of sulphur dioxide. The gas passing through the thermo coil cools the air surrounding the thermostat very rapidly and affects the sulphur dioxide sealed within the bellows, causing it to expand with more heat and contract with less.

These expansions and contractions of the bellows are communicated to the thermostat switch just above, and these automatically throw on or off the electric current as temperature varies from one limit of the zone of Kelvination to the other.

The sensitiveness of this form of automatic control, and the soundness of the principle involved, have been proved not only by innumerable tests, but by years of dependable and efficient service in this and other fields.

Temperatures **in the Kelvinator freezing tank** vary only about 4° between stopping of the machine and its starting (usually from 18° to 22° above zero); and actual refrigerator temperatures **in the food compartments** under normal conditions vary about 5° (usually from 42° to 47° F.).



Cutaway View showing detailed construction of Kelvinator Thermostat and Thermo Coil

(b) Low Pressure Control Where the pressure system of control is used, the entire thermostat assembly is eliminated, and the control mechanism consists of an electric switch operated by two separate bellows, low pressure and high pressure.

This unit is part of the compressor assembly, and is governed directly by the amount of pressure in the refrigeration line at that point, and hence, indirectly, by the refrigerator temperature.

The ordinary operations of refrigeration are governed by the low pressure bellows, the purpose of the high pressure bellows being to open the electric switch and cut off the motor if the pressure of the liquid refrigerant in the line exceeds 140 pounds.

KELVINATOR–INSTITUTION AND PRODUCT

Long Specialized Experience

Kelvinator is the oldest manufacturing company in the field of domestic electric refrigeration—continuously and successfully in business since 1914.

The Kelvinator Corporation is a division of the Electric Refrigeration Corporation—comprising also the Nizer Corporation, pioneer manufacturer of ice cream cabinets; and the Leonard Refrigerator Company, manufacturers of Leonard Cleanable refrigerators. This firm financial position assures Kelvinator owners continuous, dependable service.

Correct Principles of Design

No major changes in design have been made since the first Kelvinator was marketed. Constant use over this long period of years has proved that the principles of automatic refrigeration originally selected for Kelvinator were sound, practical, economical and adequate to meet the rapidly growing needs of this great industry.

Since the widest possible application of these original Kelvinator principles has dictated no change in the general design, Kelvinator engineers have been able to concentrate on the refining and perfecting of each mechanical part and unit; and have brought Kelvinator to its present high point of efficiency.

The results of this refinement are reflected not only in compactness and simplicity, but in continuous trouble-free service to owners.

A One-Product Organization

Large scale precision production in modern plants, operated under one management, has lowered and stabilized the cost of Kelvinator to consumers, and has contributed materially to the economies of Kelvinator ownership.

Kelvinator is not an assembled machine. Every part, with the exception of motor and belt, is made by Kelvinator, in one-product plants where all materials and every step in manufacture can be rigidly held to high Kelvinator standards. Motors and belts are manufactured in other special production plants according to exacting Kelvinator specifications.

Highest Quality of Materials and Workmanship

The Kelvinator Corporation thus controls production at every step. Material purchases are made on detailed specifications assuring uniformly high quality. Manufacturing processes are held to equal standards. In many of the steps of precision manufacture, as in production of the thermostat, expansion valves and other parts, micrometer measurements as fine as 1/10,000 of an inch are used.

Inspection and Tests

Every part used in a Kelvinator is subject to rigid inspection. Every major assembly also receives a separate inspection. Each Kelvinator in completed form likewise undergoes a final inspection and test as a check on perfect assembly and adjustment.

Sales and Service

Kelvinator policies have one object—that Kelvinator shall give uninterrupted and highly satisfactory service to every owner.

Kelvinator parts are perfectly standardized and are interchangeable. Service men are factory trained and capable. The service organization parallels the sales organization in extent and efficiency.

Kelvinator has nation-wide distribution through a highly organized body of responsible distributors and dealers who, with the manufaturer, stand squarely back of the Kelvinator product.

Endorsements by Authorities

Added to the testimony of tens of thousands of individual Kelvinator users is the formal endorsement of Kelvinator by such authorities as the Priscilla Proving Plant, The Tribune Institute and Good Housekeeping Institute, after rigid tests in their model kitchens. Kelvinator has also been approved by the Investigating Committee of Architects and Engineers, 7 East 42nd Street, New York; Underwriters' Laboratories, Chicago; and Hydro-Electric Power Commission of Ontario, Canada.

Leading Household Authorities Endorse Kelvinator

DISTRIBUTION AND FINANCIAL STRENGTH

As a division of the Electric Refrigeration Corporation, Kelvinator not only is backed by the resources, facilities and experience of the combined companies, but has at its disposal the combined distribution and service outlets of the combined companies.

Kelvinators may now be inspected and purchased at more than 7000 points in the United States and Canada.

BALANCE SHEET

The balance sheet of Electric Refrigeration Corporation and subsidiaries, as for December 31, 1925, is as follows:

Assets

CURRENT				
Cash and U. S. Government Securities of a face value of $500,000.00 subsequently disposed of to net $499,146.63			$1,136,584.09	
Sight Drafts against Bill of Lading Shipments			95,564.65	
Notes and Title-Retaining Contracts Receivable	$1,197,952.23			
Accounts Receivable	1,878,988.82	$3,076,941.05		
Less: Allowance for Doubtful		118,243.50	2,958,697.55	
Merchandise Inventories (at lower of cost or market)				
Raw Materials and Stocks in Process		$1,598,222.16		
Finished Product and Service Parts		2,297,109.72		
Material in Transit		128,541.82		
Supplies and Shipping Materials		46,117.48	4,069,991.18	
Accrued Interest Receivable			6,875.00	$8,267,712.47
OTHER ASSETS				
Miscellaneous Real Estate and Land Contracts Receivable			$ 305,004.29	
Sundry Accounts, Loans, Advances and Investments			133,900.93	438,905.22
PERMANENT				
Land and Improvements			$ 400,969.01	
Buildings	$1,358,923.20			
Railroad Sidings	9,577.68			
Machinery and Equipment	1,086,327.66			
Patterns, Tools and Fixtures	545,225.32			
Office Furniture and Fixtures	99,564.47			
Automobiles and Trucks	22,311.34	$3,121,929.67		
Less: Allowance for Depreciation		562,323.51	2,559,606.16	
Construction in Progress			346,352.18	
Subsidiary Sales Companies' Equipment at Cost less Depreciation			16,533.05	3,323,460.40
PATENTS, GOOD-WILL AND DEVELOPMENT				778,741.11
DEFERRED				
Prepaid Expenses, Supplies, etc.			$ 148,218.55	
Advertising and Sales Promotion for 1926			159,499.38	307,717.93
				$13,116,537.13

Liabilities

CURRENT				
Notes Payable			$ 923,250.95	
Accounts Payable			788,514.96	
Accrued Accounts			50,747.22	
Due Distributors and Dealers			81,760.96	
Provisions for 1925 Federal Taxes at 13%			353,258.85	
Dividends Declared:				
Nizer Corporation		$131,705.75		
Kelvinator Corporation		126,785.77	258,491.52	$2,456,024.46
FUNDED DEBT				
Ten-Year 6% Convertible Gold Notes due January 1, 1936			$3,000,000.00	
Nizer Corporation 6½% Serial Notes due in semi-annual instalments of $75,000.00 each, commencing February 1, 1926 (Note B)			450,000.00	3,450,000.00
CAPITAL AND SURPLUS				
Authorized Issue of 2,000,000 Shares of Non-Par Value Stock, of which 571,250 shares will be issued upon complete exchange (Note C)				
Paid-In Value			$4,388,629.86	
Surplus			2,821,882.81	7,210,512.67
				$13,116,537.13

(Over)

The foregoing balance sheet is based upon giving effect to the following:

(a) The proposed acquisition of the outstanding Capital Stock of the Nizer Corporation and Kelvinator Corporation through exchange of shares.

(b) The acquisition of the outstanding Capital Stock of the Grand Rapids Refrigerator Company through purchase by exercise of present option.

(c) The issue of the balance of the treasury stock and the payment of a 1¼% stock dividend by the Nizer Corporation.

(d) The issue of $3,000,000 Ten-Year 6% Convertible Gold Notes.

(Note A) All of these transactions have been fully consummated with the exception that as at March 31, 1926, 10,470 aggregate shares of Kelvinator Corporation and Nizer Corporation common stock were unexchanged for a like number of shares of the Electric Refrigeration Corporation.

(Note B) The installment of $75,000 due February 1, 1926, was paid on that date. On March 30, 1926, the Board of Directors of the Nizer Corporation have called for redemption on August 1, 1926, the remaining $375,000 principal amount of these notes.

(Note C) As at March 31, 1926, 560,780 shares of the 571,250 shares were issued and outstanding. On March 31, 1926, there was outstanding an aggregate of 10,470 shares of Kelvinator Corporation Common Stock without nominal or par value and Nizer Corporation Class B Common Stock exchangeable for a like aggregate amount of shares of Electric Refrigeration Corporation shares of Non-Par Value Stock.

At the end of 1925, the balance sheet showed current assets of $8,267,712, against current liabilities of $2,463,024, a ratio of almost 3½ to 1.